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COOPERATIVE SNOW SURVEYS



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PROCUREMENT SECTION
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WATER SUPPLY OUTLOOK FOR WESTERN UNITED STATES

Including Columbia River Drainage in Canada

Prepared by

U. S. DEPARTMENT of AGRICULTURE ★ SOIL CONSERVATION SERVICE

Collaborating with

CALIFORNIA DEPARTMENT of WATER RESOURCES

and

**BRITISH COLUMBIA DEPARTMENT of
LANDS, FORESTS and WATER RESOURCES**

AS OF
APR. 1, 1971

TO RECIPIENTS OF WATER SUPPLY OUTLOOK REPORTS:

Most of the usable water in western states originates as mountain snowfall. This snowfall accumulates during the winter and spring, several months before the snow melts and appears as streamflow. Since the runoff from precipitation as snow is delayed, estimates of snowmelt runoff can be made well in advance of its occurrence. Streamflow forecasts published in this report are based principally on measurement of the water equivalent of the mountain snowpack.

Forecasts become more accurate as more of the data affecting runoff are measured. All forecasts assume that climatic factors during the remainder of the snow accumulation and melt season will interact with a resultant average effect on runoff. Early season forecasts are therefore subject to a greater change than those made on later dates.

The snow course measurement is obtained by sampling snow depth and water equivalent at surveyed and marked locations in mountain areas. A total of about ten samples are taken at each location. The average of these are reported as snow depth and water equivalent. These measurements are repeated in the same location near the same dates each year.

Snow surveys are made monthly or semi-monthly from January 1 through June 1 in most states. There are about 1900 snow courses in Western United States and in the Columbia Basin in British Columbia. Networks of automatic snow water equivalent and related data sensing devices, along with radio telemetry are expanding and will provide a continuous record of snow water and other parameters at key locations.

Detailed data on snow course and soil moisture measurements are presented in state and local reports. Other data on reservoir storage, summaries of precipitation, current streamflow, and soil moisture conditions at valley elevations are also included. The report for Western United States presents a broad picture of water supply outlook conditions, including selected streamflow forecasts, summary of snow accumulation to date, and storage in larger reservoirs.

Snow survey and soil moisture data for the period of record are published by the Soil Conservation Service by states about every five years. Data for the current year is summarized in a West-wide basic data summary and published about October 1 of each year.

PUBLISHED BY SOIL CONSERVATION SERVICE

The Soil Conservation Service publishes reports following the principal snow survey dates from January 1 through June 1 in cooperation with state water administrators, agricultural experiment stations and others. Copies of the reports for Western United States and all state reports may be obtained from Soil Conservation Service, Western Regional Technical Service Center, Room 209, 701 N. W. Glisan, Portland, Oregon 97209.

Copies of state and local reports may also be obtained from state offices of the Soil Conservation Service in the following states:

STATE	ADDRESS
Alaska	P. O. Box "F", Palmer, Alaska 99645
Arizona	6029 Federal Building, Phoenix, Arizona 85025
Colorado (N. Mex.)	12417 Federal Building, Denver, Colorado 80202
Idaho	Room 345, 304 N. 8th. St., Boise, Idaho 83702
Montana	P. O. Box 970, Bozeman, Montana 59715
Nevada	P. O. Box 4850, Reno Nevada 89505
Oregon	1218 S. W. Washington St., Portland, Oregon 97205
Utah	4012 Federal Bldg., 125 South State St., Salt Lake City, Utah 84111
Washington	360 U.S. Court House, Spokane, Washington 99201
Wyoming	P. O. Box 2440, Casper, Wyoming 82601

PUBLISHED BY OTHER AGENCIES

Water Supply Outlook reports prepared by other agencies include a report for California by the Water Supply Forecast and Snow Surveys Unit, California Department of Water Resources, P. O. Box 388, Sacramento, California 95802 --- and for British Columbia by the Department of Lands, Forests and Water Resources, Water Resources Service, Parliament Building, Victoria, British Columbia



WATER SUPPLY OUTLOOK FOR WESTERN UNITED STATES

Including Columbia River Drainage in Canada

ISSUED

APRIL 1, 1971

The Soil Conservation Service coordinates snow surveys conducted by its staff and many cooperators, including the Bureau of Reclamation, Corps of Engineers, Forest Service, National Park Service, Weather Bureau, Geological Survey, and other Federal Agencies, Departments of State Government, Irrigation Districts, Power Companies, and others.

The Department of Water Resources coordinates snow surveys in California.

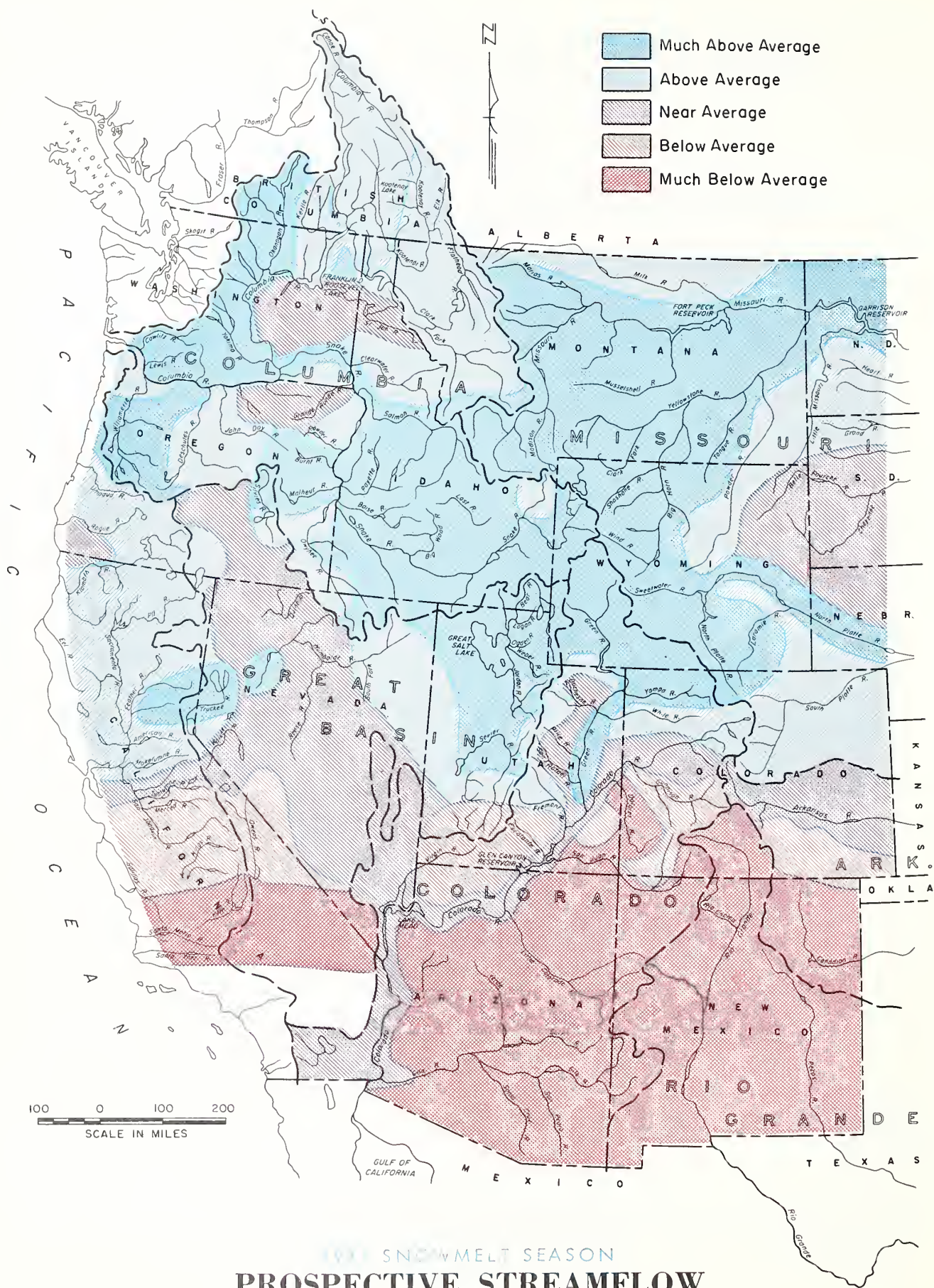
The Water Resources Service, Department of Lands, Forests, and Water Resources directs snow surveys in British Columbia.

This report was prepared by the Water Supply Forecasting Branch, Engineering Division, Soil Conservation Service, from data supplied by Snow Survey Supervisors of the Soil Conservation Service in the States of Alaska, Arizona, Colorado and New Mexico, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming.

Data from California was supplied by the Chief, Water Supply Forecast and Snow Survey Unit, Department of Water Resources.

Data from British Columbia was supplied by the Chief, Hydrology Division, Water Investigations Branch, Department of Lands, Forests and Water Resources.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
KENNETH E. GRANT, ADMINISTRATOR



1971 SNOWMELT SEASON
PROSPECTIVE STREAMFLOW
 AS OF APRIL 1, 1971

WATER SUPPLY OUTLOOK

1971 SNOWMELT SEASON
APRIL 1, 1971

ADEQUATE TO EXCELLENT WATER SUPPLIES ARE ANTICIPATED FOR MOST WESTERN AREAS THIS YEAR. RECORD TO NEAR RECORD SNOWS CREATE POTENTIAL FOR HIGH WATER PROBLEMS, PARTICULARLY IN PARTS OF IDAHO, MONTANA AND WYOMING. WATER USERS WITHOUT ADEQUATE RESERVOIR STORAGE IN ARIZONA AND NEW MEXICO CAN EXPECT WATER SHORTAGES.

March weather generally intensified the existing water supply conditions. Dry, warm weather across southern California, Arizona and New Mexico further reduced prospects for this summer's streamflow. Cool, wet storms continued a rapid snowpack build-up across northern states, down to and including a narrow band across northern California, Nevada, Utah and Colorado.

In the areas of heavy snowpack noted above, there are numerous snow courses which have either exceeded all previous records or have only one or two years of record when water content of the snow has exceeded present readings. This includes courses having records which extend back 35 to 50 years. Streamflow forecasts in the heavy snowpack areas generally range from about 140 to 200 percent of average. This applies particularly to central and southern Idaho, central and southwestern Montana, most of Wyoming, northern Utah & Colorado, some eastern Oregon streams and near Lake Tahoe on the Nevada-California border.

In contrast to the above, snow cover is essentially gone in Arizona and New Mexico. Most streams in Arizona will yield about one-fourth of their normal flow, while in New Mexico most streams will supply about 50 to 65 percent of usual amounts. In Arizona and New Mexico along the Upper Gila river there will be a need for heavy ground water pumping and a reduction in planted acreages. Fortunately, reservoir storage is essentially average on Arizona's Salt River Project and along New Mexico's Rio Grande River. This will be generally adequate, but will leave the reservoir systems with poor carryover storage for next year. Water users dependent on natural flow rights will have very short supplies.

The California Department of Water Resources reports an above normal snowpack in all the State's snow zones except the southern Sierra -- on headwaters of tributaries to the Owens Valley, San Joaquin Valley, and Tulare Lake Basin. Although some shortages can be expected in localized areas which are

without sufficient conservation facilities to meet late season irrigation demands, and those subsequently dependent upon surplus waters, no critical shortages are now foreseen for this spring.

The snowpack is generally 25 to 100 percent more than average on the major water producing areas in the United States portion of the Columbia Basin, in eastern and western portions of British Columbia. It falls off to about 15 to 20 percent above average on the Columbia and West Kootenay rivers in British Columbia, reports the British Columbia Water Resources Service, Department of Lands, Forests and Water Resources. Soil moisture and base flow of streams in this area are generally low, somewhat reducing prospective runoff from existing snowpacks.

Lowest streamflow forecast in the Columbia Basin is for Oregon's Grande Ronde River at 98 percent. Most streams originating in the Cascade Mountains of Oregon, Washington and western B. C., as well as the Montana tributary streams, Idaho's Clearwater and Salmon rivers, should all yield near 15 to 40 percent above average flows.

Streamflow prospects are less favorable in southern Colorado on the San Juan, upper Rio Grande and Dolores rivers. Here, near 60 to 70 percent of usual amounts are expected. With 70 to 90 percent of normal amounts expected, prospects are somewhat better on Colorado's Gunnison, Animas, southern tributaries to the Arkansas River, as well as for Utah's Virgin, upper Sevier and adjacent smaller streams.

Since April-July inflow to Lake Powell on the Colorado River is forecast at 111 percent average, prospects for water and power are good.

In Nevada, major streams are forecast to flow at near or above average amounts, except for the Truckee River where heavy snows indicate runoff will be near 145 percent. This, combined with excellent reservoir storage, assures good to excellent water supplies.

SUMMARY OF SNOW WATER EQUIVALENT MEASUREMENTS

APRIL 1, 1971

MAJOR BASIN AND SUB - WATERSHED	WATER EQUIVALENT IN PERCENT OF:		MAJOR BASIN AND SUB - WATERSHED	WATER EQUIVALENT IN PERCENT OF:	
	LAST YEAR	AVERAGE		LAST YEAR	AVERAGE
MISSOURI BASIN			SNAKE BASIN		
Jefferson	131	147	Snake above Jackson, Wyo.	145	152
Madison	127	143	Snake above Hiese, Idaho	139	151
Gallatin	106	146	Snake abv. American Falls Res.	158	150
Missouri Main Stem	112	138	Henry's Fork	140	145
Yellowstone	117	146	Southern Idaho Tributaries	110	140
Shoshone	133	146	Big and Little Wood	162	160
Wind	171	154	Boise	145	155
North Platte	116	158	Owyhee	80	85
South Platte	82	114	Payette	135	155
ARKANSAS BASIN			Malheur	105	140
Arkansas	78	103	Weiser	130	155
Cucharas-Purgatoire	33	39	Burnt	105	130
RIO GRANDE BASIN			Powder	110	135
Rio Grande (Colo.)	76	63	Salmon	140	140
Rio Grande abv. Otowi Bridge	22	20	Grande Ronde	130	130
Pecos	0	0	Clearwater	130	120
COLORADO BASIN			LOWER COLUMBIA BASIN		
Green (Wyo.)	161	151	Yakima	154	172
Yampa - White	108	128	Umatilla	100	115
Duchesne	120	105	John Day	100	120
Price	104	104	Deschutes - Crooked	180	140
Upper Colorado	100	124	Hood	205	160
Gunnison	86	96	Willamette	300	160
San Juan	77	58	Lewis	207	178
Dolores	64	77	Cowlitz	204	164
Virgin	125	83	PACIFIC COASTAL BASIN		
Gila	4	3	Puget Sound	218	162
Salt	0	0	Olympic Peninsula	205	139
GREAT BASIN			Umpqua - Rogue	230	145
Bear	97	158	Klamath	245	140
Logan	151	154	Trinity	155	125
Ogden	149	145	CALIFORNIA		
Weber	120	120	CENTRAL VALLEY		
Provo - Utah Lake	107	100	Upper Sacramento	145	125
Jordan	112	120	Feather	180	145
Sevier	107	99	Yuba	210	145
Walker - Carson	108	107	American	185	130
Tahoe - Truckee	156	137	Mokelumne	160	120
Humboldt	115	103	Stanislaus	130	105
Lake Co. (Oregon)	180	130	Tuolumne	125	95
Harney Basin (Oregon)	115	125	Merced	120	90
UPPER COLUMBIA BASIN			San Joaquin	120	90
Columbia (Canada)	170	118	Kings	115	85
Kootenai	152	123	Kaweah	115	75
Clark Fork	128	125	Tule	185	75
Bitterroot	126	123	Kern	100	70
Flathead	124	128	<i>Data for California Watersheds supplied by Dept. of Water Resources, and for British Columbia Watersheds by Dept. of Lands, Forests and Water Resources.</i>		
Spokane	135	125			
Okanogan	158	140	<i>Average is for 1953-67 period. California averages are for the period 1931-70. Based on Selected Snow Courses determined by Dis- tribution within the Basin, Length of Record and Repetitive Monthly Measurement Schedules.</i>		
Methow	145	135			
Chelan	191	142			
Wenatchee	179	170			

With isolated exceptions, storage in principal irrigation reservoirs is average or well above in all western states. Some reservoirs have been drawn down early to provide space for anticipated high water.

MISSOURI BASIN

Storms during March brought abnormally heavy increases to the snowpack. Now, record or near record high snows lie on most Missouri Basin watersheds. Many individual snow courses in Montana, Wyoming and northern Colorado now have the most snow water they have ever recorded for this time of year, with records extending back 35 to 50 years.

Lightest snow cover (11 percent above average) in Montana is on the Milk River near the Canadian border. All other Missouri River drainages have snowpacks which range from about 135 to 145 percent average. The snow is particularly high on the Jefferson, Madison, Gallatin and Marias rivers. With the exception of the Judith-Musselshell area, all drainages have a larger snowpack than last year. Streamflow forecasts for these rivers range from about 130 to 180 percent average.

The Yellowstone drainage above the Big Horn River has a snowpack that is 146 percent average. To the south in Wyoming the snow is 145 to 155 percent on the Shoshone and Wind rivers. While snow in the Big Horn and Little Big Horn mountains is less than last year, it is still 35 to 40 percent above average. Snow cover in the Laramie Mountains-Deer Creek range has improved since last month and is now above average. Flow of Clark's Fork, the Shoshone and Wind-Big Horn rivers is expected to be near 140 to 160 percent average. Flow of streams from the Big Horn and Little Big Horn mountains should be near 10 to 30 percent above average.

On the North Platte drainage, the record snowpack indicates that inflow to Seminole Reservoir will be 176 percent. Forecast percentages for tributaries to the North Platte include the Laramie 152 percent, Encampment 167 percent and Little Laramie 208 percent.

Snows are lighter in eastern Wyoming and South Dakota, but the Belle Fourche and Cheyenne rivers should produce average water supplies.

Snows are also lighter on the South Platte in Colorado, but water supplies should be excellent. Streams should yield 10 to 20 percent above usual amounts. Reservoir storage is 140 percent normal.

ARKANSAS BASIN

Snow cover is average on the upper Arkansas River above Salida, Colorado, but it

falls off rapidly on southern tributaries. Flow of the Arkansas is expected to be 97 percent of average at Salida. This, with good reservoir storage, should provide satisfactory water supplies this year. The Cucharas and Purgatoire rivers currently have streamflow prospects of 75 and 87 percent of average amounts, respectively.

In New Mexico the snow has gone on the Canadian River, leaving prospects for spring and summer flows to be very low unless summer rainfall is high. However, present storage in Conchas Reservoir is 95 percent of average.

RIO GRANDE BASIN

Water supply prospects became poorer during March due to warm, dry weather. In the Colorado portion of the basin this weather started premature melt of low and medium elevation snowpacks. In New Mexico, all snow is now gone from these elevations. There is no snow on the Pecos River and only 20 percent on the Rio Grande above Otowi Bridge. It is somewhat higher on the upper Rio Grande in Colorado, but still very low with only 63 percent average.

River flows will be low and last only a short time. Flow of the Rio Grande near Del Norte is expected to be about 66 percent of average. Inflow to the river system from the Conejos River near Mogote and the Chama River at El Vado Reservoir should be near 66 and 59 percent, respectively. Total flow of the Rio Grande at Otowi Bridge is forecast at 55 percent. Outlook for the Pecos River is 49 percent.

Carryover storage is within a few percent of being average in Elephant Butte Reservoir. Water users who are dependent on direct flow from rivers will feel the major effect of the low streamflow. They will have very short, early season supplies unless summer rainfall is much above normal.

COLORADO BASIN

The present snow cover in the upper Colorado River Basin is favorable as a whole, but shows marked variability within the Basin. The heaviest snow cover is on tributaries to the Green River in Wyoming and averages near 150 percent of usual amounts. The snow decreases steadily to the south, with about 125 to 130 percent snowpacks lying on watersheds of the Yampa, White and upper Colorado rivers. It decreases to near average on the Duchesne, Price, San Rafael and Gunnison rivers. It decreases further to a low of 58 percent on the San Juan River. Average snow cover for the entire upper Colorado is near 10 percent above the usual amount.

The generally favorable snowpack, combined

SELECTED STREAMFLOW FORECASTS

APRIL 1, 1971

STREAM AND STATION	FORECASTS THIS YEAR		Forecast Period	Last Year's Flow In (1,000 A.F.)
	Flow In (1,000 A.F.)	Percent of Average		
UPPER MISSOURI				
Jefferson at Sappington, Montana	1,510	159	April-Sept	
Madison near Grayling, Montana <u>1/</u>	635	147	April-Sept	502
Gallatin near Gateway, Montana	690	150	April-Sept	664
Sun at Gibson Dam, Montana <u>3/</u>	810	134	April-Sept	555
Belt near Monarch, Montana	194	178	April-Sept	222
Marias near Shelby, Montana <u>4/</u>	790	131	April-Sept	646
Missouri near Lundusky, Montana <u>2/</u>	6,800	152	April-Sept	
S. F. Musselshell above Martinsdale, Montana	67	145	April-Sept	77
Milk near Eastern Crossing, Montana	290	111	April-Sept	
Yellowstone at Yellowstone Lake Outlet, Wyo.	1,220	146	April-Oct	
Yellowstone at Corwin Springs, Montana	2,700	144	April-Sept	2,172
Clark Fork at Belfry, Montana	840	144	April-Sept	
Shoshone, Inflow to Buffalo Bill Res., Wyo.	1,130	140	April-Sept	
Wind at Dubois, Wyoming	146	147	April-Sept	
Wind at Riverton, Wyoming	1,035	159	April-Sept	
Bull Lake near Lenore, Wyoming	253	142	April-Sept	
Tensleep near Tensleep, Wyoming	81	110	April-Sept	
Medicine Lodge near Hyattville, Wyoming	24.5	124	April-Sept	
Shell Creek near Shell, Wyoming	83	125	April-Sept	
Big Horn at St. Xavier	2,700	157	April-Sept	2,105
Tongue near Dayton, Wyoming	137	133	April-Sept	
Yellowstone at Miles City, Montana <u>5/</u>	9,100	156	April-Sept	
Missouri near Williston, N. Dak. <u>6/</u>	17,000	155	April-Sept	
PLATTE				
North Platte at Saratoga, Wyoming	975	176	April-Sept	
Encampment near Encampment	212	167	April-Sept	
Laramie near Jelm, Wyoming <u>7/</u>	158	152	April-Sept	
Big Thompson at Drake, Colorado	112	112	April-Sept	
Clear at Golden, Colorado	145	122	April-Sept	
St. Vrain at Lyons, Colorado	78	111	April-Sept	
Cache LaPoudre near Fort Collins, Colorado <u>8/</u>	250	116	April-Sept	
ARKANSAS				
Arkansas at Salida, Colorado <u>9/</u>	300	97	April-Sept	
Cucharas near LaVeta, Colorado	9	75	April-Sept	
Purgatoire at Trinidad, Colorado	40	87	April-Sept	
RIO GRANDE				
Rio Grande near Del Norte, Colorado <u>10/</u>	290	66	April-Sept	
Conejos near Mogote, Colorado <u>11/</u>	120	66	April-Sept	
El Vado Res., Inflow, New Mexico	110	59	March-July	
Rio Grande at Otowi Bridge, New Mex. <u>12/</u>	280	55	March-July	
Pecos at Pecos, New Mexico	20	49	March-July	
UPPER COLORADO				
Granby Reservoir Inflow, Colorado <u>13/</u>	275	126	April-Sept	
Colorado at Dotsero, Colorado <u>14/</u>	1,600	116	April-Sept	
Roaring Fork at Glenwood Springs, Colorado <u>15/</u>	730	105	April-Sept	
Colorado near Cameo, Colorado <u>16/</u>	2,480	112	April-Sept	
Uncomphagre at Colona, Colorado	100	78	April-Sept	
Gunnison near Grand Junction, Colorado <u>16/</u>	1,000	88	April-Sept	
Dolores at Dolores, Colorado	175	67	April-Sept	
Colorado near Cisco, Utah <u>16/</u>	2,680	96	April-July	4,066
Green at Warren Bridge, Wyoming	476	147	April-Sept	
New Fork near Boulder, Wyoming	336	159	April-Sept	
Flaming Gorge Res., Utah, Net Inflow <u>17/</u>	1,748	166	April-July	985
Yampa at Steamboat Springs, Colorado	340	131	April-Sept	
Yampa near Maybell, Colorado	1,130	132	April-Sept	
Little Snake near Dixon, Wyoming	415	160	April-Sept	
White near Meeker, Colorado	355	121	April-Sept	

Forecasts in California provided by Department of Water Resources.
Average is for 1953-67 period except California. California is computed for 1921-70 period.
Forecasts assume average Effective Climate Conditions from Date Through Snow Melt Season.

Explanatory Notes on Forecasts listed on Inside Back Cover.

SELECTED STREAMFLOW FORECASTS

APRIL 1, 1971

STREAM AND STATION	FORECASTS THIS YEAR		Forecast Period	Last Year's Flow In (1,000 A.F.)
	Flow In (1,000 A.F.)	Percent of Average		
UPPER COLORADO (continued)				
Duchesne near Tabiona, Utah <u>18/</u>	98	104	April-July	
Whiterocks near Whiterocks, Utah	55	108	April-July	55
Duchesne at Randlett, Utah	295	113	April-July	
Scofield Reservoir, Utah, Net Inflow <u>19/</u>	35	109	April-July	30
Green at Green River, Utah <u>17/</u>	3,654	142	April-July	2,970
Navajo Reservoir Inflow, New Mexico	370	60	April-July	446
Animas at Durango, Colorado	320	78	April-Sept	
San Juan near Bluff, Utah <u>20/</u>	545	61	April-July	698
Colorado, Inflow to Lake Powell, Arizona <u>21/</u>	7,275	111	April-July	8,220
LOWER COLORADO				
Virgin near Virgin, Utah	34	89	April-June	21
Little Colorado above Lyman, Arizona	0.2	3	April-June	3.5
Gila near Solomon, Arizona	7	20	April-May	18.7
Frisco at Clifton, Arizona	4.5	24	April-May	10.6
Salt at Intake, Arizona	26	21	April-May	98
Tonto above Roosevelt, Arizona	1.5	20	April-May	3.1
Verde above Horseshoe Dam, Arizona	20	40	April-May	28
GREAT BASIN				
Bear at Harer, Idaho	450	199	April-Sept	
Logan near Logan, Utah <u>22/</u>	164	166	April-July	
Ogden, Inflow to Pine View Res., Utah <u>23/</u>	155	172	April-June	105
Weber near Oakley, Utah	130	140	April-June	111
Utah Lake, Utah, Net Inflow	260	133	April-July	
Big Cottonwood near Salt Lake City, Utah	41	121	April-July	38
Beaver near Beaver, Utah	21	111	April-July	23
Sevier near Hatch, Utah	28	85	April-July	22
Sevier near Gunnison, Utah	50	161	April-July	68
Humboldt at Palisades, Nevada	170	110	April-July	218
Truckee at Farad, California <u>26/</u>	375	145	April-July	196
East Carson near Gardnerville, Nevada	196	112	April-July	185
West Walker near Coleville, California	150	105	April-July	133
Donner und Blitzen near Frenchglen, Oregon	65	127	April-July	
Silvies near Burns, Oregon	122	151	April-July	
Chewaucan near Paisley, Oregon	95	120	April-July	
Deep above Adel, Oregon	95	148	April-July	
UPPER COLUMBIA				
Columbia at Revelstoke, British Columbia	18,470	101	April-Sept	15,040
Kootenai at Libby, Montana	8,750	109	April-Sept	5,362
Kootenai at Leonia, Idaho	10,250	111	April-Sept	6,256
Blackfoot near Bonner, Montana	1,230	122	April-Sept	977
Flathead near Columbia Falls, Montana <u>27/</u>	7,900	122	April-Sept	5,791
Flathead near Polson, Montana <u>27/</u>	9,480	123	April-Sept	6,828
Clark Fork above Missoula, Montana	2,160	123	April-Sept	1,786
Bitterroot near Darby, Montana	740	133	April-Sept	629
Clark Fork at Plains, Montana <u>27/</u>	15,610	125	April-Sept	11,901
Columbia at Birchbank, British Columbia <u>27/</u>	48,200	104	April-Sept	34,443
Priest near Priest River, Idaho	980	107	April-July	679
Pend Oreille below Box Canyon, Washington	19,500	122	April-Sept	14,234
Kettle near Laurier, Washington	2,260	118	April-Sept	1,123
Spokane at Post Falls, Idaho <u>28/</u>	3,300	105	April-Sept	2,839
Columbia at Grand Coulee, Washington <u>27/</u>	72,200	111	April-Sept	54,604
Okanogan near Tonasket, Washington	2,360	136	April-Sept	923
Methow near Pateros, Washington	1,380	131	April-Sept	622
Stehekin at Stehekin, Washington	1,180	130	April-Sept	
Chelan at Chelan, Washington <u>29/</u>	1,710	135	April-Sept	907
Wenatchee at Peshastin, Washington	2,270	125	April-Sept	1,416

Forecasts in California provided by Department of Water Resources.
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Forecasts assume average Effective Climate Conditions from Date Through Snow Melt Season.

Explanatory Notes on Forecasts listed on Inside Back Cover.

SELECTED STREAMFLOW FORECASTS

APRIL 1, 1971

STREAM AND STATION	FORECASTS THIS YEAR		Forecast Period	Last Year's Flow In (1,000 A.F.)
	Flow In (1,000 A.F.)	Percent of Average		
SNAKE				
SNAKE above Palisades Res., Wyoming 30/	3,960	155	April-Sept	
Grey's above Palisade, Wyoming	545	151	April-Sept	
Salt above Palisade, Wyoming	535	167	April-Sept	
SNAKE near Heise, Idaho 30/	5,550	148	April-Sept	4,050
Henry's Fork near Rexburg, Idaho 31/	1,475	120	April-Sept	
Teton near St. Anthony, Idaho	500	127	April-Sept	
Big Lost near Mackay, Idaho 32/	230	137	April-Sept	203
Blackfoot Reservoir Inflow, Idaho	150	147	April-Sept	
Portneuf at Topaz, Idaho	120	151	March-Sept	
Salmon Falls Creek nr San Jacinto, Idaho	125	179	March-Sept	
Big Wood, Inflow to Magic Res., Idaho 33/	480	183	April-Sept	248
Bruneau near Hot Springs, Idaho	300	157	March-Sept	
Owyhee Res., Net Inflow, Oregon	360	128	April-July	
Boise near Boise, Idaho 34/	2,500	161	April-Sept	1,658
Malheur near Drewsey, Oregon	113	159	April-July	
Payette near Horseshoe Bend, Idaho 35/	2,750	150	April-Sept	2,066
Weiser abv. Crane Creek, Idaho	800	159	March-Sept	
SNAKE at Weiser, Idaho	8,700	138	April-Sept	7,172
Powder near Baker, Oregon	75	125	April-July	
Imnaha at Imnaha, Idaho	365	119	April-Sept	295
Salmon at Whitebird, Idaho	9,000	131	April-Sept	7,378
Grande Ronde at LaGrande, Oregon	169	98	April-July	153
Clearwater at Spalding, Idaho	10,500	122	April-Sept	7,982
LOWER COLUMBIA				
Yakima at Cle Elum, Washington 36/	1,320	136	April-Sept	
Umatilla at Pendleton, Oregon	151	101	April-July	
John Day, Middle Fork at Ritter, Oregon	155	138	April-July	108
Crooked near Post, Oregon	114	115	April-July	
Deschutes at Benham Falls, Oregon 37/	443	113	April-July	
Columbia at The Dalles, Oregon 27/	125,000	119	April-Sept	87,067
Hood near Hood River, Oregon 37/	370	131	April-July	
Willamette at Salem, Oregon 37/	5,400	115	April-July	
Lewis at Ariel, Washington 38/	1,880	138	April-Sept	869
Cowlitz at Castle Rock, Washington	3,660	130	April-Sept	2,079
NORTH PACIFIC COASTAL				
Dungeness near Sequim, Washington	190	110	April-Sept	
Umpqua, North, near Toketee Falls, Oregon	202	115	April-Sept	
Rogue at Raygold, Oregon	924	118	April-July	536
Klamath Lake, Net Inflow, Oregon	602	118	April-July	287
Trinity at Lewiston, California	800	130	April-July	434
CALIFORNIA CENTRAL VALLEY 39/				
Sacramento, Inflow to Shasta, California	2,100	118	April-July	1,364
Feather near Oroville, California	2,400	129	April-July	1,116
Yuba at Smartville, California	1,420	132	April-July	611
American, Inflow to Folsom Res., California	1,620	123	April-July	816
Cosummes at Michigan Bar, California	170	117	April-July	67
Mokelumne, Inflow to Pardee Res., Calif.	520	112	April-July	397
Stanislaus, Inflow to Melones Res., Calif.	690	96	April-July	590
Tuolumne, Inflow to Don Pedro Res., Calif.	1,020	85	April-July	1,045
Merced, Inflow to Exchequer Res., Calif.	450	74	April-July	465
San Joaquin, Inflow to Millerton Lake, Calif.	950	80	April-July	907
Kings, Inflow to Pine Flat Res., California	840	72	April-July	871
Kaweah, Inflow to Terminus Res., California	190	70	April-July	204
Tule, Inflow to Success Res., California	30	51	April-July	32
Kern, Inflow to Isabella Res., California	220	53	April-July	317
ALASKA				
Chena at Fairbanks, Alaska	805	182	May-June	174
Salcha near Salchaket, Alaska	1,040	177	May-June	275

Forecasts in California provided by Department of Water Resources.
Average is for 1953-67 period except California. California is computed for 1921-70 period.
Forecasts assume average Effective Climate Conditions from Date Through Snow Melt Season.

Explanatory Notes on Forecasts listed on Inside Back Cover.

with generally above average soil moisture conditions and above average reservoir storage, provide a satisfactory to excellent water supply outlook for next summer for all water users. The principal exception will be along the Dolores and San Juan rivers for those water users who are served by natural flow rights. From 30 to 40 percent less than average streamflow is expected here.

Forecasts for tributary streams in Wyoming range from 140 to 190 percent of average. Total inflow to Flaming Gorge Reservoir in Utah is expected to be 166 percent. The Little Snake near Dixon, Wyoming is forecast at 160 percent. In Colorado the Yampa and White rivers should yield 20 to 30 percent more than usual. Streams expected to produce within 10 to 15 percent of normal amounts include Roaring Fork, Gunnison, Duchesne, Price and San Rafael rivers. The Animas and Uncompahgre are forecast at 78 percent. Unregulated flow of the principal tributaries is forecast as follows: Green at Green River, Utah 142 percent; Colorado near Cisco, Utah 96 percent and San Juan near Bluff, Utah 61 percent. Total inflow to Lake Powell, Arizona is forecast at 7,275,000 acre-feet for the April-July period, or 111 percent average. Storage in irrigation reservoirs is well above average.

March weather continued the dry, warm pattern in all areas of the Lower Colorado Basin. Now, all watersheds have prospects for below normal runoff. Brightest outlook is for the Virgin River (89 percent) and the Santa Clara (61 percent). Streamflow forecasts in Arizona range from a low of 3 percent on the Little Colorado to 40 percent on the Verde River. Flow of other streams - the Gila, Salt, Frisco and Tonto - will be about 20 to 25 percent average.

Water supplies will be very short along the Upper Gila River and on the San Carlos Project. Heavy ground water pumping and a reduction in planted acreages will be required. Due to present reservoir storage, which is near average, the Salt River Project will have adequate water supplies. Carry-over storage for next year will be low.

GREAT BASIN

March storms brought heavy increases to the snowpack in northern Nevada and in Utah north of Salt Lake. In southern areas of both states, however, dry and warm weather depleted the snow. With the exception of smaller drainages in southern areas of Utah, Nevada and California where snow is generally about 10 to 20 percent below average, all other watersheds in the Great Basin have a snowpack which varies from near average to about 200 percent on some Idaho tributaries to

the Bear River. In Nevada, snow cover ranges from average on the Humboldt River to 147 percent on the Truckee River.

The present snowpack, combined with excellent reservoir storage, assures good to excellent water supplies next summer for all major irrigated areas.

In Utah, streamflow forecasts range from about 15 percent below average in southern areas to near twice normal amounts on tributaries of the Weber, Ogden and Bear rivers. Expected flow of streams tributary to Utah Lake and the Jordan River range from 104 percent on the American Fork River, to 160 percent on Parley's Creek. Total inflow to Utah Lake is forecast at 133 percent. Streams tributary to the San Pitch River should yield 15 to 20 percent more than usual, while the Sevier near Gunnison should be near 160 percent. Reservoir storage in Utah is unusually good, as typified by Utah Lake (145 percent), Strawberry (157 percent) and combined storage in the three principal Sevier River reservoirs (210 percent).

In Nevada, streamflow forecasts range from near or a little above average on the Walker, Carson and Humboldt rivers, to 145 percent on the Truckee River. Reservoir storage is also excellent in Nevada, with all major reservoirs storing well above normal (about 140 percent) amounts for this date.

Oregon streams in Lake and Harney counties should yield well above average amounts. Forecasts range between 120 and 150 percent average.

COLUMBIA BASIN

Water supplies are expected to be generally excellent throughout the Columbia Basin this year. All areas have an average or considerably better outlook.

Cool, wet weather with heavy snowpack build-up during March has more than offset the effect of February's warm, dry weather. With the exception of the Palouse and Owyhee rivers, where the snow is 10 to 15 percent less than average, the entire Columbia Basin has an above normal snowpack. The snow is particularly heavy along the Cascade Mountains of Oregon, Washington and western British Columbia, and on Snake River tributaries in south central and southern Idaho. In these areas the snow ranges from about 140 to 200 percent of average.

In the areas of heavy snowpack noted above, numerous snow courses have either exceeded all previous records or have only one or two years when water content of the snow was higher. This included courses with records

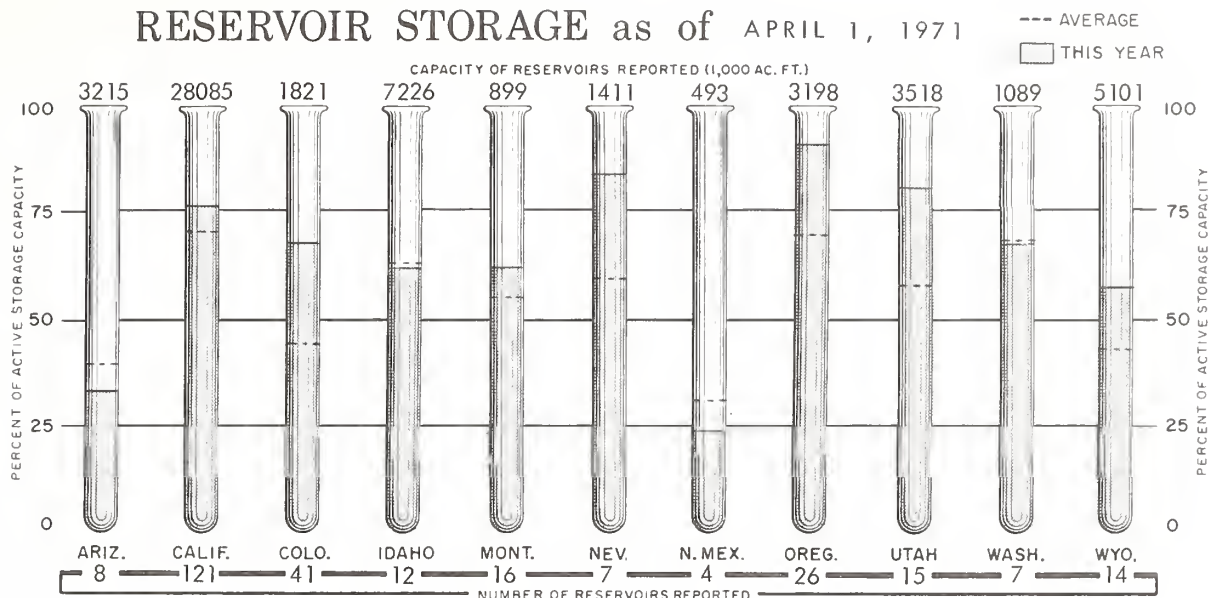
STORAGE IN LARGE RESERVOIRS

APRIL 1, 1971

BASIN AND NAME OF RESERVOIR	CAPACITY (1,000 A.F.)	STORAGE (1,000 A.F.)	STORAGE PERCENT AVERAGE	BASIN AND NAME OF RESERVOIR	CAPACITY (1,000 A.F.)	STORAGE (1,000 A.F.)	STORAGE PERCENT AVERAGE
UPPER MISSOURI				UPPER COLUMBIA			
Belle Fourche	185	150	156	Chelan	676	180	106
Boysen	550	179	48	Coeur d'Alene	225	138	89
Buffalo Bill	373	132	103	Duncan	1,347	77	---
Canyon Ferry	2,043	1,444	93	Flathead	1,791	732	98
Fort Peck	19,140	16,200	147	Hungry Horse	3,428	1,980	95
Garrison	24,500	20,404	186	Kootenay	673	138	84
Hebgen	377	282	159	Lower Arrow	3,083	0	0
Keyhole	192	128	334	Noxon Rapids	335	206	110
Lake Francis Case	5,816	3,776	100	Pend Oreille	1,155	386	91
Lake Sharp	1,900	1,765	106	Roosevelt	5,232	1,534	65
Oahe	23,630	21,243	168	Upper Arrow	4,061	0	0
Tiber	1,347	462	72	LOWER COLUMBIA			
Big Horn	1,356	862	120	Cougar	155	53	---
PLATTE				Detroit	300	108	64
City of Denver (5)	507	469	146	Hills Creek	200	65	54
Colo-Big Thompson (3)	718	574	136	Lookout Point	337	114	58
Glendo	784	455	131	Yakima Res. (5)	1,066	708	99
Pathfinder	1,016	906	214	SNAKE			
Seminole	1,010	350	123	American Falls	1,700	1,675	105
ARKANSAS				Anderson Ranch	423	203	96
Conchas	273	153	95	Arrowrock	287	195	83
John Martin	354	35	39	Brownlee	980	229	---
RIO GRANDE				Cascade	653	266	98
Elephant Butte	2,195	317	95	Jackson	847	611	142
El Vado	195	1	100	Lucky Peak	278	38	31
UPPER COLORADO				Owyhee	715	698	146
Blue Mesa	830	306	---	Palisades	1,200	610	84
Flaming Gorge	3,749	1,874	---	PACIFIC COASTAL			
Navajo	1,696	882	---	Clair Engle	2,448	2,312	111
Powell	25,002	12,434	---	Clear Lake	440	400	160
LOWER COLORADO				Nacimiento	350	175	88
Havasu	619	560	101	Ross	1,203	757	106
Mead	26,159	16,289	101	Upper Klamath	584	525	112
Mohave	1,810	1,666	98	CALIFORNIA CENTRAL VALLEY			
Salt River Res. (4)	1,755	863	86	Almanor	1,036	761	106
San Carlos	985	0.2	0	Berryessa	1,602	1,623	107
Verde River Res. (2)	318	173	132	Folsom	1,010	794	140
GREAT BASIN				Isabella	570	165	103
Bear	1,421	1,091	122	McClure	1,026	595	103
Lahontan	286	237	109	Millerton	521	351	109
Rye Patch	179	190	226	New Bullards Bar	930	642	73
Sevier Bridge	236	233	243	Oroville	3,484	3,247	111
Strawberry	274	194	157	Pine Flat	1,013	670	119
Tahoe	732	560	130	Shasta	4,500	4,269	113
Utah	884	870	145				
Willard Bay	193	182	---				

Reservoir Storage Data Provided by Bureau of Reclamation, Corps of Engineers, Geological Survey, and water using organizations. Data from California and British Columbia provided by Department of Water Resources and Department of Lands, Forests and Water Resources, respectively.

RESERVOIR STORAGE as of APRIL 1, 1971



extending back 35 to 50 years.

The snow is also well above average (120 to 140 percent) in most of central and eastern Oregon, on Idaho's Salmon, Clearwater and Spokane rivers, all Montana tributaries and on British Columbia's east Kootenay River. Streams where snows are 10 to 20 percent above the normal include Oregon's Umatilla River, Idaho's Priest River and British Columbia's west Kootenay, upper and lower Columbia rivers.

All streams are now forecast to yield average to well above average flows. An adverse sequence of temperatures and/or precipitation during the main snowmelt period could produce very hazardous runoff conditions in many areas, particularly in southern Idaho, in Wyoming and along the Cascade mountains.

Streamflow forecasts follow the snow pattern. As examples, inflow to Magic Reservoir on Idaho's Big Wood River is forecast at 183 percent. Salmon Falls Creek at 179 percent, and Wyoming's Salt River at 167 percent. Oregon's Grande Rond and Umatilla rivers are forecast at essentially average amounts. The Columbia at The Dalles, Oregon is expected to produce 125 million acre-feet during the April-September period, or 119 percent average.

Reservoir storage is average or better in all states, in spite of the fact that reservoirs in critical areas have and are being drawn down to provide more space for handling expected high water.

ALASKA

Although very little additional snow fell throughout interior Alaska during the month of

March, the snowpack in this large region is considerably above average. Maximum of record snow depths and water contents have been measured in several areas. The Chena River watershed above Fairbanks has an exceptionally heavy snow cover and high water is expected during the snowmelt season.

Above normal Spring flows can also be expected on the Salcha, Tanana, Yukon, Koyukuk, Kuskokwim and Susitna rivers.

Streamflow forecasts for the Chena and Salcha rivers illustrate the expected effect of these deep snows. The May-June runoff of the Chena at Fairbanks is forecast at 182 percent, while the Salcha near Salchaket is forecast at 177 percent.

Snow cover is above average in the mountains of southeast Alaska, but near normal in the Chugach Mountains near Anchorage.

Soils in the interior are drier than normal and will absorb a portion of the melting snowpack.

CALIFORNIA

The California Department of Water Resources, coordinating agency for snow surveys and water supply forecasting in California, reports that spring runoff forecasts based on April 1 snow surveys indicate that all snow-fed streams will have above normal flows except those fed from the southern half of the Sierra range. The vagaries of weather were again aptly demonstrated in California during March. The northern portion of the State, with its usual water surplus and above normal water supply conditions on March 1, received March precipitation in amounts as high as two and one-half times normal for the month.

South of San Francisco Bay, March rainfall amounts were only one-half or less of that normally expected. In California, April 1 is generally considered to be the end of the snow accumulation season and the beginning of the melt period. After April 1, there is little hope of improving the water supply situation. This will be a dry year in the lower Central Valley, which will call for use of carryover storages from past years. Although various degrees of close water management will be widespread here, no critical deficiencies in irrigation supplies are anticipated.

March precipitation for California came in two storms. The first, during the second week, produced two to five inches of rain at stations in the northern part of the State and on the third day extended south, providing Southern California with light rains. Following ten days of warm weather, with average temperatures from 2 to 4 degrees above normal, the second storm began. This storm, as the first, started fairly warm, turning cold as it progressed but was generally restricted north of Tulare Lake. Precipitation amounts for this storm were 2 to 6 inches on the North Coast, 1 to 2 inches in the Sacramento Valley and 3 to 7 inches in the central Sierra. Total rainfall during the month was 110 percent of the 40-year average, ranging from over 200 percent of normal along the Oregon boarder to 15 percent of normal at San Diego with no measurable rainfall in the desert regions. Seasonal precipitation for the period October through March was 105 percent of normal for the State, ranging from normal to 150 percent of normal north of the San Francisco Bay area and between 70 and 90 percent of normal to the south, except for the Santa Clara River Basin and the desert regions, which are 110 and 15 percent of normal, respectively.

April 1 measurements, which historically reflect the State's snowpack maximum water content accumulation, were made at all snow

courses and 23 reporting snow sensors in California. Except for the snow courses south of the Tehachapi Mountains, these measurements varied from zero to about 200 percent of normal for this date. From the Tuolumne River Basin north, the individual measurements of snow water content were near normal or above. South of the Tuolumne River Basin, almost all measurements were below normal. Overall, the water content in the California snowpack was 115 percent of the 40-year April 1 average.

April-July runoff forecasts for Central Valley snowmelt streams averaged 105 percent of normal. While all Sacramento Valley stream forecasts are above normal, forecasts for San Joaquin Valley tributaries are from 50 to 95 percent of normal. Lahontan area streams draining the east side of the Sierra range also reflect similar conditions, with above normal flows forecasted from the Carson River Basin north and below average runoff forecasted for all streams to the south.

March runoff from California major streams was 150 percent of average, with extremes from 230 percent of average for the Salmon River in the North Coastal area to 5 percent of normal from the Santa Ana River in the South Coastal area. Generally, runoff from all major streams north of the San Francisco Bay were above normal and those to the south were below normal with coastal streams averaging only 20 percent of their normal March flows. Seasonal runoff for the period October through March for the State was 145 percent of normal, with Central Valley tributaries averaging 120 percent of normal.

As of April 1, 121 of the major reservoirs in California were storing 21,307,000 acre-feet. This storage is 76 percent of their aggregate capacity and 110 percent of their 10-year average. From that reported one year ago, there has been a net decrease of about 900,000 acre-feet.



EXPLANATION of STREAMFLOW FORECASTS

All flows are observed flows except as adjusted for: 1/ Change in storage in Hebgen Lake. 2/ Change in storage in Canyon Ferry and Tiber reservoirs. 3/ Change in storage in Gibson Reservoir and measured diversions. 4/ Change in storage in Two Medicine, Four Horns and Lake Francis reservoirs. 5/ Change in storage in Boysen and Buffalo Bill reservoirs.

6/ Change in storage in Boysen, Buffalo Bill, Canyon Ferry, Tiber, and Fort Peck reservoirs. 7/ Plus diversions to Cache la Poudre. 8/ Minus diversions from North Platte, Laramie, and Colorado rivers plus measured diversions above station. 9/ Change in storage in Twin Lakes and Sugar Loaf reservoirs minus diversions from Colorado River. 10/ Change in storage in Rio Grande, Santa Maria, and Continental reservoirs.

11/ Change in storage in Platoro Reservoir. 12/ Change in storage in El Vado Reservoir. 13/ Change in storage in Granby Reservoir plus diversions to Cache la Poudre and through Adams Tunnel. 14/ Changes as indicated in (13) plus Moffat Tunnel diversion. 15/ Plus diversions to Arkansas River.

16/ Change in storage in Blue Mesa reservoir. 17/ Change in storage in Flaming Gorge, Fontenelle and Big Sandy reservoirs. 18/ Plus diversion through Duchesne Tunnel. 19/ Change in storage in Scofield Reservoir. 20/ Change in storage in Navaho Reservoir.

2 21/ (Lee's Ferry) Change in storage in Flaming Gorge, Navajo, Lake Powell and Big Sandy reservoirs. 22/ Plus Utah Power and Light Company tailrace and Logan, Hyde Park, and Smithfield canals. 23/ (Inflow record computed by U. S. Bureau of Reclamation.) 24/ Plus diversion by Weber-Provo Canal and change in storage in Wanship Reservoir. 25/ Change in storage in Deer Creek Reservoir, minus diversions through Duchesne Tunnel and Weber-Provo Canal, plus diversion through Salt Lake City Aqueduct.

26/ Change of storage in Lake Tahoe and Boca Reservoir. (Forecast by Truckee Basin Committee) 27/ Change in storage in any of these reservoirs above the station: Kootenai Lake, Hungry Horse, Flathead Lake, Pend Oreille Lake, F. D. Roosevelt Lake, Lake Chelan, Coeur d'Alene Lake, Brownlee and Noxon; and pumpage at Roosevelt Lake. 28/ Changes in storage in Coeur d'Alene Lake and diversions by Spokane Valley Farms Company and Rathdrum Prairie canals. 29/ Change in storage in Lake Chelan. 30/ Changes in storage for Jackson Lake and Palisades Reservoir above stations. 30/

31/ Change in storage in Henry's Lake, Island Park and Grassy Lake reservoirs and diversions between Ashton and Rexburg. 32/ Change in storage in Mackay Reservoir, and diversion in Sharp Ditch. 33/ (Combined flow Big Wood River nr. Bellevue and Camas Creek nr. Blaine.) 34/ Change in storage in Arrowrock, Anderson Ranch, and Lucky Peak. 35/ Change in storage in Cascade and Deadwood reservoirs. 36/ Change in storage in Keechelus, Kachess, and Cle Elum reservoirs plus diversion by Kittitas Canal. 37/ (Corrected to natural flow). 38/ Change in storage in Merwin, Yale, and Swift reservoirs. 39/ (Corrected for upstream impairments).

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